THE RANKING OF NORTH COAST COHO STREAMS FOR REARING PRODUCTIVITY AND BIODIVERSITY: SUPPLEMENTAL FISHERIES REPORT FOR THE NORTH COAST LAND RESOURCE MANAGEMENT PLAN

DATA SUPPLIED FOR: THE COMMUNITY FISHERIES DEVELOPMENT CENTRE

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ABSTRACT

This report was initiated to supplement additional information for the North Coast Land Resource Management Plan (NCLRMP) Fisheries Section in assessing priority watersheds. Escapement data from the Fisheries and Oceans (FAO) database from 1950-2001 on returning adult salmon to their natal streams located within the NCLRMP land base is being used to evaluate the potential richness of biomass or carrying capacity of different salmon stocks within these systems.

However, information on adult coho (*Oncorhynchus kisutch*) escapement is the weakest of the data sources due to the difficulties and timing of observing adult coho in-migration because of extreme high river flows in the late summer and fall. In order to have a better understanding of the current state of coho stocks in terms of productivity, data from three juvenile coho synoptic programs from 1998-2001 were used to produce an ***Overall Index of Rearing Productivity*** from 79 surveyed streams using two types of productivity index, ***Catch per Unit Effort (CPUE)*** and ***Density (fish/m^2)*** of juvenile coho. A ***Composite Index of Rearing Productivity*** was also produced to show regional difference in juvenile coho rearing productivity of sampled streams within the NCLRMP boundaries.

In addition, summaries of streams based on diversity of species captured, and presence/absence of steelhead are provided. The data showed that for all the streams surveyed, 97% of the streams have two or more resident fish in their freshwater assemblages. In a determination of whether a stream might be a possible steelhead stream, summaries on juvenile rainbows presence or absence was recorded with 61% of the streams having juvenile rainbows in their freshwater assemblages.

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1. INTRODUCTION

1.1. Project Rationale

The basis of this report is to supplement additional information for coho salmon within the North Coast LRMP Fisheries Section on Priority watersheds. The LRMP Fisheries team has used information to derive a ***Rich Ecosystem Rank*** based on Fisheries and Oceans adult escapement data from 1950-2001 and other supplemental data from consultant reports, forestry studies and personal observations. The weakest of these data sources would be the adult coho (*Oncorhynchus kisutch*) escapement data due to the lack of observation due to the lateness in the year and long duration of adult coho in-migration into the streams and also the difficulty of enumerating these fish under usually high water conditions in the fall.

The LRMP Government Technical Team, in consultation with the Fisheries Sector decided that it would be appropriate to supplement the adult coho data with information that has been recorded from juvenile coho synoptic studies that have been done on many streams on the Lower Skeena and coastal systems within the LRMP land-base. Data has been obtained from three sources:

1. North Coast Stream Inventory Program (1998-2001)
2. Oona River Stream Inventory Program (1998)
3. Fisheries Charter Vessels Survey Program (1998-2001)

The utilization of the data from the 79 streams surveyed between the three programs will be used as an aid to the Fisheries and Oceans adult escapement database for coho in the ranking of coho within the ***Rich Ecosystem Rank***. Rankings were accomplished by producing an ***Index of Rearing Productivity Ranking*** that was derived by utilizing a composite of ***CPUE/Site Area*** and ***Density (Fish/m^2)*** indexes. Also added in this study was information pertaining to ***Vulnerable and/or Unique Freshwater Fish Populations*** based on data recorded in the stream surveys on the presence or absence of different resident freshwater fish. The possibility of some of these streams being anadromous steelhead systems was based on the presence or absence of juvenile rainbows

2. STREAM LOCATIONS

All the streams surveyed for gathering data on juvenile coho population dynamics within the three inventory programs were within the LRMP land-base and have been identified and geo-referenced by either UTM coordinates, Fisheries Statistical Areas/sub-areas or watershed codes. All of the streams from the juvenile synoptic programs are within Fisheries Statistical Areas 3, 4, 5 or 6. The range of the sampled systems are from the Kitsault River at the top of Observatory Inlet in Fish sub-area 3-14 to Barnard Harbour in Whale Channel in Fish sub-area 6-6. Systems surveyed on the lower Skeena river (Area 4) went as far as Kwinista which is 70 km east of Prince Rupert on the west bank of the Skeena river.

3. JUVENILE COHO FIELD ASSESSMENT PROGRAMS

3.1. North Coast Stream Inventory Program (NCSIP)

This program was funded jointly by Fisheries Renewal BC (FRsBC) and the Habitat Restoration Program (HRSEP) for four years (1998-2001). The funding was allocated for doing a four-year juvenile coho synoptic study on selected streams within Area 3, 4, 5, and 6 (Area 7 was done in 1998 by Kitasoo). The program comprised all North Coast communities in having a stream inventory crew of 3-4 stream technicians and a support vessel for transportation from all the different communities (Kincolith, Port Simpson, Metlakatla, Prince Rupert (3 groups), Kitkatla, Oona River, Hartley Bay and Kitasoo). Biologists from the Community Fisheries Development Centre and Fisheries and Oceans trained the stream technicians by holding training workshops throughout the program. Many of the systems have a four-year time series of data that includes mapping components of habitat, water characteristics, population enumeration, and juvenile fish measurements.

3.2. Oona River Stream Inventory Program (ORSIP)

This program was funded in 1998 by HRSEP for doing juvenile coho synoptic studies in and around the areas close to Porcher Island, Grenville Channel and Petrel Channel. This study was done for six months and Oona River became part of the NCSIP program in 1999.

3.3. Fisheries Charter Vessel Survey Program (FCVSP)

This program started in 1998 where Fisheries and Oceans charter vessel patrolmen in Area 3, 4, 5 and 6 conducted juvenile coho synoptic surveys in different streams within their chartered area. These surveys were conducted in conjunction with their regular surveys of doing adult salmon enumeration in these systems.

4. METHODOLOGY

4.1. Sampling Protocols

All the programs used the same methodology for doing juvenile coho synoptic surveys in the different streams. Site-specific juvenile coho densities were sampled and estimated using a mark and recapture protocol developed by Blair Holby, Fisheries and Ocean Scientist at the Pacific Biological Station, Nanaimo. Fish sampling was conducted using minnow traps that were baited with pre-frozen and/or salted salmon roe. Traps were left in typical rearing habitats of juvenile salmonids, such as, in pools, under cut-banks, behind logjams or in beaver ponds. The number of traps in a site was usually 20 minnow traps.

Site lengths were based on habitat units, which are the distance between consecutive riffles in a riffle-pool-riffle sequence and most sites were usually between 30 meters to 50 meters long. Many streams would have more than one site and up to four in many streams but the average was usually two sites in a stream.

Fishing time for the gee traps was usually 90 minutes and all juvenile coho captured on the First Trapping were marked by clipping a small portion of the lower caudal fin and then released back into the stream. The assumption is that the juvenile coho express a territorial behaviour in which they hold their positions within a stream area and therefore would not move out of the site boundaries of the habitat unit after release. Second trapping in the same sites were usually done 48 hours later (assumption is that this duration would allow the previous clipped fish not to be trap shy and therefore eliminate bias between previously caught fish and new fish entering the trap on second trapping) and the juvenile coho were then observed for marking so that the tally on the second trapping would show both marked and unmarked fish. This information can then be used for making a population estimation of juvenile coho in the site area using the Petersen's method of population estimation.

5. INDEX OF REARING PRODUCTIVITY

The trapping data collected were analyzed to provide an index of juvenile coho rearing productivity. This index is valuable in that salmonid productivity is typically measured by escapement data, which for coho is a poor indicator as escapement data for this species is weak due to the environmental factors that make coho difficult to count.

The analyzed data need to be considered as an index rather than an absolute measure of productivity because:

- Data were not collected from each stream each year in a rigorously similar manner. Different times of year, different crews, and different stream conditions encountered were confounding factors.
- Mark/recapture efforts could not be implemented in each stream every year.
- CPUE data are confounded by different sampling conditions.

Regardless, the collected data do provide valuable insight into potential juvenile coho rearing productivity of the systems assessed.

The collected data allow for two similar calculations of rearing productivity. The first uses the Peterson mark/recapture method to estimate the total fish population within the site area, which when divided by the site area provides fish density (Fish/m^2). The second method calculates the CPUE (Fish per trap hour) divided by the site area to provide CPUE/Site Area (Fish/trap hour/m^2). Both methods are described below.

5.1. Population Estimation

This comparison of both marked and unmarked fish in the second trapping alongside the number of fish marked in the first trapping would allow a population estimation using the Petersen method. This is shown by:

$N=MC / R$

Where: N = *Population Estimation*

M = *Number of Fish marked First Trapping and Released*

C = *Total number of Fish caught in Second Trapping (Recapture)*

R = *Number of marked Fish caught in Recapture*

5.2. Area of Site

Area for the sites was estimated from averaging four or five wetted widths throughout the site and multiplying it by the length of the site.

Site Area (m^2) = (Average of 4 – 5 channel widths of sites (m)) * (Length of site (m))

5.3. Density (fish/m^2)

The area measurement alongside the population estimation would allow the calculation of the density of juvenile fish that are in the site (fish/m^2) and this can be estimated by:

D = N/ A
Where: D = Density (fish/m^2)
N = Population Estimation
A = Area of Sampling Site (m^2)

Density Stream Ranking = ***Averaged Density of different sites in system each year and then use this average through the years of the program for an overall density for the system.***

In some stream systems, the second trapping was not completed, and as such the calculation of the number of fish in a site (and the subsequent calculation of fish density) could not be completed.

5.4. Catch per Unit Effort (fish per trap hour)

Catch per Unit Effort (CPUE) was calculated by using the number of minnow traps set within the boundaries of the site, the time that the minnow's traps were in the site area and the number of juvenile coho caught in the First Trapping.

CPUE = ((C / T) / S) * 60
Where: C = Juvenile coho caught in First Trapping
T = Number of minnow traps in Site
S = Soak time in minutes
***** The formula is multiplied by 60 to convert the CPUE to the number of fish caught per trap per hour***

CPUE / Site Area was used as another relative index for ranking different streams within the NCSIP and ORSIP program. Dividing the CPUE by the site area standardizes the CPUE for all the streams so that averaged CPUE's in the sites within the different systems can be used as a ranking system for the different systems for another index of productivity. The CPUE could not be calculated for the FCVSP data because they did not have the information on set and haul times of the trap in their data surveys forms.

CPUE Stream Ranking = Averaged CPUE / Area
Where:

Averaged CPUE = Catch per unit effort is averaged between the different sites in a system for the year. These CPUE's are then averaged across the year for an overall average for the system
Area = Averaged channel widths * Site Length

6. RESIDENT FISH AND STEELHEAD

In addition to the coho rearing data, information on resident fish species diversity and potential steelhead presence has also been pulled out from the collected data.

6.1. Resident Fish

The resident fish that are found in most coastal streams are freshwater sculpins (*Cottus asper)* , cutthroat trout *(Oncorhynchus clarkii*), stickleback *(Gasterosteus Aculeatus*), Dolly Varden (*Salvelinus malma*) and rainbows (*Oncorhynchus mykiss*). There is very little information in both provincial and federal fisheries databases on the presence or absence of these fish in coastal systems. The NCSIP and the ORSIP program recorded the presence or absence of these different species on their data forms so that an index was produced from 0 to 5 indicating the diversity of these species present within freshwater assemblages of a stream. An index of "0" would indicate no resident fish present and an index of "5" would indicate all 5 species were present in the system. There has been no distinction made between anadromous (sea-run) or non-anadromous species since the sampling of these juveniles was done in freshwater sites.

Resident Fish Stream Index = 0 – 5

6.2. Steelhead

High value is put on systems that have steelhead populations for recreational fisheries but there is an absence of data on adult steelhead population dynamics within coastal systems on the North Coast. The presence of juvenile rainbows in the system may indicate that a stream has population of anadromous steelheads so that an index was done using juvenile rainbows presence or absence in the system from data gathered from the NCSIP and ORSIP programs. An index of "0" indicates no presence of rainbows and an index of "1" indicates a presence of rainbows in the system.

Rainbow Presence Stream Ranking: Present (1) or Absent (0)

7. RESULTS/DISCUSSION

The three Juvenile Coho Assessment Programs combined contribute 79 different stream's juvenile coho data sets for a period from one to four years. However, there are more than 219 coho systems that are listed in the Fisheries escapement data for 1950-2001, which applies to the North Coast LRMP, and some of the streams with juvenile data do not correlate with streams that have adult escapements. The juvenile data does contribute additional information to the LRMP by providing information on potential coho rearing productivity, as measured by CPUE/site area and/or by Fish Density. Additional

information about resident species diversity and steelhead presence/absence is also provided.

Using the calculated indexes, stream systems were ranked in order from highest to lowest, both across the entire study area, and within regional sub-areas. This ranking is done by calculating the:

1. Average CPUE / Site Area in a Stream by year
2. Average Density of Sites in a Stream by year
3. Producing an Overall Index of Rearing Productivity

In addition, summaries of streams based on diversity of species captured, and presence/absence of steelhead are provided.

7.1. Overall Index of Rearing Productivity using both Juvenile Coho CPUE/Site Area and Density Rankings

The CPUE/Site Area and Density rankings were used to determine an Overall Index of Rearing Productivity as shown in Table 2 in the Appendix. CPUE/Site Area rankings were based on 64 streams and Density rankings were based on 70 streams. Overall rankings for streams were categorized as High (H), Medium (M) and Low (L) based on the following criteria:

1. Streams were rated ***High*** if they had an index ranking in the top 20th percentile for either the CPUE/Area or Density rankings.
2. Streams were rated ***Medium*** if they had an index ranking in the 50-80th percentile for either the CPUE/Area or Density Rankings
3. Streams were rated ***Low*** if they had both index rankings lower than the 50th percentile for the CPUE/Area and Density Rankings

7.2. Composite Index of Rearing Productivity

In order to compare regional differences within the North Coast LRMP, the streams surveyed from the three programs were grouped into 10 different regions as illustrated in Table 1. The groupings reflect realistic and regional connections between the streams. Landscape units were not used because they were not broad enough for grouping. A ***Composite Index of Rearing Productivity*** for each region was determined by assigning a numerical value of "3" to a High index, "2" to a Medium Index and a "1" to a Low index and adding all the values for each stream in a region together and dividing through by the number of streams in each region. Table 1 below show the regional ranking based on this ***Composite Index of Rearing Productivity***.

Table 1 - Composite Index of Rearing Productivity for different regions within the North Coast LRMP

REGIONS	CODE	Rank	STREAMS INCLUDED IN REGION	Composite Index of Rearing Productivity
Lower Skeena	Skeena	1	Kwinsta, Antigonish, Aberdeen, Marigonish, Inver, Basalt, Stapledon, Valley(Khyex),	2.63
Grenville	Gren	2	McNeil, Moore Cove, Bremner, Paat, Kubas	2.20
Kincolith	Kin	3	Kitsault, Wilauks, Welda, Dogfish, Chambers, Illiance, Stagoo, Lizard, Crag	2.11
Inside Area	Inside	4	Wolf (Pt Ed), Denise, Diana, Kloiya, Prudhomme, Lost Creek	2.0
Tsimshian Penisula	PS	5	Haida, Cabin, Big Bay, Stumaun, Salt Lake, Slippery Rock, Tea Bay, Swamp Island, La Hou, Tracy Bay, Sandy Bay	1.81
Hartley Bay	HB	6	Keesil, Kitkiata, Quaal, Kiskosh, Malsey, Riordan, Paril, Barnard, Foch, Gilttoyees	1.70
PRupert Harbour	Harb	7	Airport, Scott Inlet, McNichol, Silver, Shawatlans, Moresby, Uriah, Hays	1.63
Porcher	Por	7	Spiller, Chismore, Oona River, Hunt's Inlet, Humpback Bay, Alpha, Skene, Big Useless	1.63
Porcher Inlet	PorIn	9	Head, Salt Lagoon, Porcher Creek, Wolf	1.5
Kitkatla	Kit	10	Billy Bay, Phoenix, Snass, Table Bay, Shaw Kooryet, Hevenor, Bolton, MarkleNewcombe	1.20

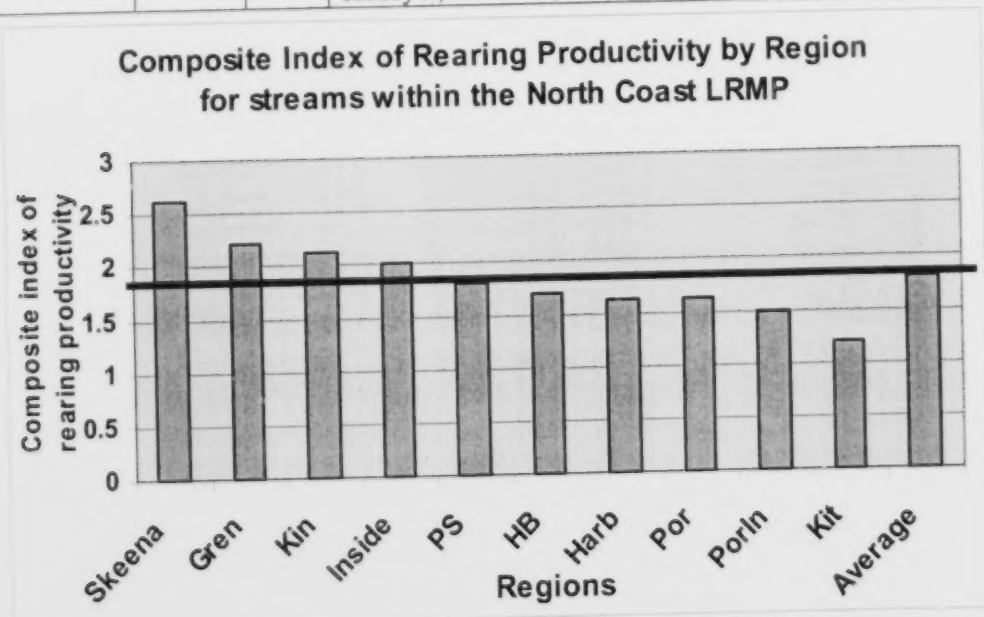

Figure 1 - Composite Index of Rearing Productivity by Region for streams surveyed within the North Coast LRMP region.

In Fig 1 the red line on the graph is the average composite index of rearing productivity for all the regions combined. The four most productive regions from the survey data is the Lower Skeena, Grenville, Kincolith and the Inside Area.

7.3. Regional Rankings and Summary of Regions within the North Coast LRMP

The Summary of Streams surveyed in Juvenile Coho Field Assessment Programs and the rankings of these streams can be found in Table 3 in the Appendix. The rankings of the different regions and summaries are outlined below:

Lower Skeena Region (Rank 1)

The streams representing the Lower Skeena region may play a very important part in the overall production of coho salmon on the entire Skeena River. These streams may act as temporary refuge areas for out migrating coho juveniles who enter these adjacent streams off the main river for short periods of times because they are not ready to enter the marine environment. All of these adjacent streams which are part of the Lower Skeena grouping are located in the upper tidal areas of the lower Skeena River. There is some work being done by Fisheries and Oceans to test this theory by conducting DNA analysis on juvenile fry within these systems to see if they are native to these particular streams or match them to streams in the upper areas of the Skeena system. Six of the eight streams that were surveyed in this region were above the 50th percentile on the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Kwinista (H), Antigonish (H), Inver (H), Basalt (H), Stapledon (H), Valley (Khyex) (H).

Grenville Region (Rank 2)

Systems in the Grenville region comprise systems that are near the mouth of the Skeena River. The systems in this region would have adult coho in-migration from late August to early November and these runs would be minimally impacted by the gillnet fishery on the Skeena River during the summer. There is minimal sport-fishing activity in this area but there is continuous logging activity in the upper Grenville area. All of the systems that were surveyed ranked higher than the 50th percentile for the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: McNeil (H), Moore (M), Bremner (M), Pa-aat (M), Kubas (M)

Kincolith Region (Rank 3)

The streams in the Kincolth group and especially Observatory Inlet such as Welda, Kitsault and Wilauks and other streams in the vicinity of Kincolith such as Dogfish are very productive systems. During the NCSIP program some of the highest catches of

juvenile fry were from Chambers Creek which has also been subject to past logging activity. These streams are located in a very remote area with very little sport fishing activity in this area. The area has a commercial net fishery in Subarea 3-12 and 3-7 which is mainly concerned with Nass sockeye and peaks in first week of July. There would be minimal impacts on both late summer and fall in migrating adult coho apart from food fishing activity from First Nations out of Kincolith or by interception by sports fishermen from the top end of Dundas and the bottom of Wales Island. Six of the nine streams surveyed in this region were over the 50th percentile on the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Kitsault (H), Wilauks (H), Welda (H), Chambers (H), Dogfish (M), Lizard (M)

Inside Region (Rank 4)

The streams in this region are located from the inside of Morse Basin into Prudhomme Lake. This area represents a high use area because of its proximity to Prince Rupert and Port Edward and its importance to recreational activities for both sports fishing, camping and picnicking. There is easy access to this area because Highway 16 between Prince Rupert and Terrace runs right beside most of these systems. Four of the systems (Diana, Kloiya, Prudhomme and Lost Creek) in this area border on Prudhomme Lake which is a favorite area for sports fishermen because of its easy access by road. Coho stocks in Diana Creek and Kloiya Creek have been enhanced over the years by the efforts of the Prince Rupert Salmon Enhancement Society. One system in this grouping, Denise Creek has shown continuous degradation in rearing productivity to the point that coho stocks in this stream are on the verge of extinction. Five of the six systems surveyed in this area were ranked higher than the 50th percentile in the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Lost Creek (H), Diana (M), Kloiya (M), Prudhomme (M), Wolf (Port Ed) (M)

Tsimshian Pensiula Region (Rank 5)

Many streams on the Tsimshian Penisula like Stumaun Creek have been affected by past logging activities which have resulted in local debris jams and slides. It is reported that there are more than 30 beaver dams on Stumaun Creek. Most of the systems surveyed in this area were around the Port Simpson area, Big Bay area and down the Tsimshian Peninsula towards Tugwell Island. Tracy Bay Creek is at the bottom of Wales Island and Sandy Creek is on Dundas Island. This region is a very important area for sports fishermen with many fishing charters and sports fishermen working the Work Channel area, Dundas and Melville Island areas and down the Tsimshian Penisula towards Metlakatla Pass. Commercial fishing for Nass and Skeena Sockeye in this area is from early June to late July. Most of the streams in this area would have late run summer and fall adult coho stocks entering these systems and there could be a possible impact on late summer coho because of the fishing activity in this area. Six of the eleven systems

surveyed in this region were over the 50th percentile on the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Haida (H), Stumaun (H), Swamp Island (M), La Hou (H), Cabin (M), Salt Lake (M)

Hartley Bay Region (Rank 6)

Streams that were sampled in this region were mainly from the Douglas Channel area. Riordan in Ursula Channel, Paril near Gardiner Channel and Barnard in Wales Channel were the other three streams surveyed in this area. The Quaal system was given a high rating because it is a large system and the sampling in this system was done in small tributaries near the river mouth. Five of the ten streams surveyed in this region scored over the 50th percentile in the Overall Index of Rearing Productivity

Systems ranked above the 50th percentile: Quaal (H), Riordan (H), Kiskosh (M), Malsey (M), Gilttoyees (M)

Prince Rupert Harbour Region (Rank 7)

Streams sampled in this region ranged from Tuck Inlet to Metlakatla Pass. Some streams such as Silver Creek have been impacted by logging but in-stream rehabilitation work was done in this system in 2001 to improve rearing capacity. Silver is another example of a system that has adequate rearing area due to some beaver dams in the system but low spawning productivity and its ranking was changed to a low rank. Hays Creek is a system that has been under steady enhancement for coho using volunteers from the Prince Rupert Salmon Enhancement Society. Many of these streams such as Moresby and Hays are recreational areas for residents of Prince Rupert. Streams such as McNichol, Scott Inlet Creek and Airport Creek could be affected by future development of the Tsimshian Penisula such as the proposed road to the Airport on Digby Island. Three of the eight streams surveyed in this region were over the 50th percentile of the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Airport (H), Hays (H), Moresby (M)

Porcher Island Region (Rank 7)

Streams in the Porcher Island group are usually bog fed systems. Many of the systems on Porcher like Spiller River and Humpback Bay have been impacted by logging which has created debris jams and continual increases in beaver dam sites. Though a system like Spiller River ranked reasonably high in an index of rearing productivity it is actually a low productive system that is not limited by rearing capacity in the stream but by spawning area due to siltation from slope instability on the Spiller Range. Many systems on Porcher Island such as Hunt's Inlet Creeks are small meandering ditches (1-2 meters) wide and therefore their ranking becomes biased due to the small sampling areas. Hunt's Inlet was ranked low because it is not a very productive system. Oona River is another stream that borders a small community settlement and it has enhancement activities on

that system that has brought the number of coho up in that system which was given a medium ranking. Alpha Bay was included in this regional ranking because it is 1.5 km directly across Ogden Channel from Porcher Island on Pitt Island. Many of the streams at the top of Porcher Island such as Humpback, Hunt's Inlet have small settlements of permanent residents or summer homes. This area borders the southern part of Chatham Sound and it is an important area for recreational fishing from June to September. Commercial gillnet operation from late June to late July operate quite extensively in the Porcher Island region but these operations would have minimal impacts on late summer and fall run coho in-migration into these streams. Five of the eight streams grouped in this region ranked higher than the 50th percentile on the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Spiller (M), Chismore (M), Oona River (M) Skene (M), Alpha Bay (M)

Porcher Inlet Region (Rank 9)

This region is the large inlet that cuts through the middle of Porcher Island. Four streams have been surveyed in this area. Many of the streams are bog fed streams in this region and are not very wide. Some streams such as Salt Lagoon Creek in the past couple years are showing increasing numbers of adult coho returning to these systems. The ranking for this system has been increased from low to medium based on this new data. Two of the four systems surveyed in this region were over the 50th percentile for the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Salt Lagoon (M), Head (M)

Kitkatla Region (Rank 10)

Systems in the Kitkatla Area comprise systems that are in Petrel Channel, Kitkatla Inlet, from lower Principe Channel to the top of Browning Entrance. This is a large area and most of the streams sampled in the different juvenile coho field assessment programs have all shown low productivity in this region. This is an isolated region that would have received low impact from both commercial and sports fishermen. Logging activity has existed and is on going in this region. Two of the ten streams surveyed in this region were over the 50th percentile for the Overall Index of Rearing Productivity.

Systems ranked above the 50th percentile: Snass (M), Table Bay (M)

7.4. Stream Ranking on Number of Resident Fish Present

The Resident Fish Ranking is based on the streams that were surveyed over four years in the NCSIP and ORSIP program. The ranking is from "0" to "5" based on the number of juvenile resident fish that have been observed from the juvenile synoptic coho surveys. All of the data from these surveys suggest that five resident fish make up the possible assemblage of resident fish (Cutthroat, Dolly Varden, Freshwater Sculpins, Stickleback and Rainbows) in these systems. The ranking of these streams for resident fish can be

found in Table 4 in the Appendix. The breakdown of the 64 streams is shown in the Table 2 below:

Table 2 - Frequency of Resident Fish in Streams from the Juvenile Coho Field Assessment Programs

No. of Resident Fish in Stream	Number of Streams	Percent Relative Frequency
0	2	3
1	0	0
2	19	30
3	20	31
4	16	25
5	7	11

Table 2 shows that for the 64 streams that had recorded data on resident fish, 97% of the streams has at least 2 or more resident fish in the stream's freshwater fish assemblages.

7.5. Streams Ranked for Potential Steelhead Systems

A ranking of systems for steelhead populations was assessed because streams that may be potential steelhead systems are considered high value because of sport fishing recreational opportunities. The juvenile synoptic surveys within the NCSIP and ORSIP program identified juvenile rainbows in these systems but it is difficult to distinguish whether these rainbows are anadromous or non-anadromous. The rankings are based on the presence of juvenile rainbows in the stream and a ranking of "0" mean absent and "1" means present. The full listing of the rankings is shown in Table 4 in the Appendix. The summary of the 64 streams showed that 39 streams had rainbows present and 24 streams had no rainbows present.

8. CONCLUSION

All streams within the NCLRMP are considered valuable as they collectively contribute to the biodiversity and overall fish biomass within the NCLRMP boundaries.

Some regions are very important such as the Lower Skeena region and Kincolith region because of the overall productivity that is observed in these regions. Streams within the Lower Skeena and Nass regions may be very important areas because juvenile coho from the upper areas may use these streams as temporary refuges before they enter the marine environment. The Inside Region, which includes the streams off Prudhomme Lake and the Prince Rupert Harbour region are important areas for recreational use because of their location and easy access by road and small vessels. Many of the other streams within the NCLRMP are quite isolated and impacts to the productivity of these systems are usually related to industrial applications.

Ninety-seven percent of the streams surveyed had 2 or more resident fish in their freshwater assemblage and 39 out of 64 sampled streams had juvenile rainbows which shows these systems could be potential steelhead streams.

9. APPENDIX

Table 3 - Summary of Streams surveyed in Juvenile Coho Field Assessment Programs

Overall Index of Rearing Productivity	Stream Name	Rank Cpue/ Site Area	Rank Density Fish/m^2	Fish Area	Yearly Ave Cpue/Site Area				Yearly Ave Density fish/m^2				DFO Adult Escapements	UTM Coordinates
					1998	1999	2000	2001	1998	1999	2000	2001		
H	Basalt	1	1	4-15			0.0625	0.134				9.5	NO	448844 6010068
H	Chambers	2	NA	3-18		0.0072	0.15	0.0124					YES	437384 6085820
H	Lost	3	4	4-11	0.06		0.046	0.08	3.79			3.98	NO	426043 6010782
H	Stapledon	4	6	4-15			0.0464	0.029			4.21	1.73	NO	436605 6006535
H	Inver	5	12	4-15	0.0345	0.0375	0.036	0.02	1.21	2.71	3.09	1.67	NO	442945 6009575
H	Riordan	6	3	6-3		0.0224	0.0319	0.024		5.01	7.15	0.72	YES	502281 592000
H	Kitsault	7	NA	3-14			0.01	0.036					YES	469237 6149626
H	Hays	8	17	4-11	0.0079	0.022	0.035	0.024	1.69	1.35	3.19		YES	414726 6020102
H	Valley(Khyex)	9	11	4-15	0.0128	0.0223	0.0123	0.027	1.43	2.76	1.38	3.78	YES	447997 6014477
H	Welda	10	NA	3-18			0.021	0.0155					NO	443914 6086452
H	Haida Bay	11	NA	3-4				0.0176					NO	406988 6053887
H	Wilauks	12	2	3-14				0.0173				7.55	YES	471597 6148786
H	Airport	13	25	4-11	0.0318	0.0146	0.0165	0.0059	2.68	0.72	1.71		NO	408353 6018240
M	Snass	14	30	5-4				0.017				1.28	YES	396704 5975003
L	Hunt's Inlet	15	54	4-9	0.0115			0.0094	0.97			0.3	YES	405398 5990402
M	Kiskosh	16	41	6-2	0.0375	0.0004	0.0074	0.0045	0.57		1.1	0.89	YES	481387 5929304
M	Bremner	17	20	4-12	0.0055	0.026	0.0063	0.0221	0.46	1.83	1.47	3.92	NO	424107 5999627
H	McNeil	18	13	4-15	0.0162	0.0171	0.0171	0.0094	1.98	2.23	2.78	1.62	YES	435315 6009984
H	Antigonish	19	10	4-15	0.0196	0.019	0.0077	0.011	1.53	2.24	3.14	2.55	NO	444520 6010969
M	Malsey	20	22	6-2	0.0028	0.019	0.0169	0.0111	1.03	1.36	2.72	2.26	NO	478953 5916940
M	Kubas	21	34	5-1	0.0119				1.15				NO	426323 5971360
M	Dogfish	22	31	3-13	0.015	0.011	0.0086	0.0097	0.61		0.87	2.36	YES	408353 6018240
M	Skene	23	56	5-2		0.0142	0.0078			0.59	0.46		NO	409378 5967689
M	Moore Cove	24	32	4-15	0.0025	0.0101	0.0222	0.0051	2.14	1.27	1.07	0.56	YES	429125 5981659
M	Spiller River	25	21	4-12	0.0092	0.0037	0.018	0.006	1.12	0.54	2.15	3.63	YES	415207 5985508
H	Kwinitsa	26	5	4-15	0.0013	0.0073	0.0217	0.0048	0.05	5.24	6.9	1.52	YES	461962 6009554
M	Chismore	27	63	4-12	0.0084				0.36				NO	415000 5987638

Table 3 (cont) Summary of Streams surveyed in Juvenile Coho Field Assessment Programs

Overall Index of Rearing Productivity	Stream Name	Rank Cpue/ Site Area	Rank Density Fish/m^2	Fish Area	Yearly Ave Cpue/Site Area				Yearly Ave Density fish/m^2				DFO Adult Escapements	UTM Coordinates
					1998	1999	2000	2001	1998	1999	2000	2001		
M	Prudhomme	28	37	4-11	0.0087	0.0087	0.0076	0.0081	0.74	1.21	0.81	1.19	YES	429978 6013580
M	Marigonish	29	16	4-15			0.014	0.0027			3.68	0.48	NO	444958 6010782
M	Moresby	30	26	4-11	0.0027		0.009	0.0128	1.49		1.8	1.65	NO	412698 6016937
M	Head	31	44	5-9	0.0082				0.84				YES	412419 5980272
M	Cabin	32	NA	4-8				0.0081					NO	409111 6034577
L	Stagoo	33	NA	3-14		0.0018	0.0107	0.0107			1.51	2.73	YES	452598 6127467
M	Wolf(Port Ed)	34	35	4-11		0.005	0.0041	0.013		0.52	1.19	1.47	NO	416630 6009639
L	McNichol	35	38	4-11	0.0064	0.0064	0.0092	0.0078	0.52	0.45	1.63	1.29	YES	412968 6021492
L	Aberdeen	36	49	4-15	0.0052	0.0084	0.0078	0.0063	0.24	1.32	0.8	0.59	NO	440227 6007917
L	Scott Inlet	37	69	4-11	0.0065	0.0098	0.0049	0.0038	0.2	0.31	0.14	0.12	NO	408684 6022472
L	Tea Bay	38	46	4-10				0.0061				0.78	NO	405649 6021925
L	Humpback	39	60	4-9	0.0059				0.44				YES	409915 5993037
M	Diana	40	23	4-11	0.0046	0.0056	0.0078	0.0041	0.67	1.66	3.1		YES	424017 6009325
M	Kloiya	41	24	4-11	0.0036	0.0084	0.0078	0.002	0.73	1.21	3.12	1.97	YES	423046 6010397
L	Phoenix	42	50	5-4			0.0041	0.0065			0.66	0.82	YES	401020 5973244
M	Salt Lake	43	33	3-5				0.0048				1.16	NO	410660 6046581
M	Salt Lagoon	44	40	5-9	0.004	0.002	0.0027	0.0107	0.59	0.67	0.65	1.54	YES	411907 5983665
L	Illiance	45	NA	3-14		0.0045							YES	471505 6147074
H	LaHou	46	7	4-7		0.0028	0.0048	0.0052		1.38	4.48	3	YES	409185 6043318
M	Oona River	47	51	4-9	0.0043				0.7				YES	416985 5978945
L	Billy Bay	48	55	5-3		0.0036	0.003	0.0064		0.44	0.72	0.51	YES	405517 5969091
M	Swamp Island	49	14	4-9	0.0036	0.0034	0.0089	0.0031	1.38	3.09	1.95		NO	404367 6026145
M	Table Bay	50	19	5-13		0.0019	0.0031	0.0065		2.92	0.64	2.37	NO	412320 5944258
L	Silver	51	9	4-11	0.0044	0.0043	0.0028	0.0027	0.63	2.14	6.06	0.81	YES	409361 6028720
L	Big Bay	52	57	4-8		0.002	0.0051			0.54	0.5		NO	409109 6034621
H	Stumaun	53	8	4-7		0.0023	0.0022	0.0105		0.39	4.68	2.44	YES	410725 6046409
L	Porcher	54	52	5-7	0.0078		0.0005	0.0018	0.61	0.33		1.14	YES	405837 5982650
H	Quaal	55	42	6-2	0.0008	0.0057				0.85			YES	479859 5944100

Table 3 (cont) Summary of Streams surveyed in Juvenile Coho Field Assessment Programs

Overall Index of Rearing Productivity	Stream Name	Rank Cpue/ Site Area	Rank Density Fish/m^2	Fish Area	Yearly Ave Cpue/Site Area				Yearly Ave Density fish/m^2				DFO Adult Escapements	UTM Coordinates
					1998	1999	2000	2001	1998	1999	2000	2001		
L	Slippery Rock	56	62	4-9	0.0022	0.0045	0.004	0.0016	0.33	0.57	0.41	0.32	NO	404106 6028698
M	Pa-aat	57	29	5-23	0.0013		0.0054	0.0027			0.45	2.45	YES	433623 5963378
L	Uriah	58	58	4-11	0.0017	0.0021	0.0024	0.0045	0.6	0.25	0.45	0.66	NO	414371 6018809
L	Shawatlans	59	59	4-11			0.0024	0.0006			0.48		NO	420535 6028981
L	Denise	60	61	4-11	0.0016	0.0024	0.0011	0.0004	0.37	0.44	0.49		YES	425182 6014651
L	Wolf	61	68	5-9	0.0008				0.2				YES	409991 5979995
L	Shaw	62	NA	5-14	0.0005								YES	425585 5947381
L	Kitkiata	63	NA	6-2				0.0003					YES	482624 5943451
L	Keesil	64	NA	6-2	0.0002				0.07				YES	484166 5922005
L	Sandy Bay	NA	64	3-7					0.28	0.44	0.46		YES	381179 6051589
M	Lizard Ck	NA	27	3-12						0.47	1.05	3.04	YES	421303 6083101
L	Tracy Bay	NA	65	3-7							0.31	0.45	YES	401664 6064988
L	Crag	NA	47	3								0.78	NO	
L	Big Useless	NA	67	4-9								0.22	YES	397893 5988978
L	Kooryet	NA	45	5-17						0.53	0.6	1.36	YES	441591 5910627
M	Alpha Bay	NA	18	5-2					0.61	2.05	3.5	1.96	YES	415784 5968860
L	Hevenor	NA	39	5-15					0.45	0.6	1.65		YES	434238 5944708
L	Bolton	NA	66	5-17							0.33	0.2	YES	437662 5917951
L	Markle Inlet	NA	43	5-16							1.01	0.69	YES	440150 5940294
L	Newcombe	NA	70	5-14								0.17	YES	428615 5953420
L	Paril	NA	48	6-3							0.85	0.68	YES	515898 5926418
L	Barnard	NA	53	6-6							1.29	0.08	YES	491998 5878411
L	Foch	NA	36	6-1								1.03	NO	493363 5959909
M	Gilttoyees	NA	28	6-1								1.47	NO	498397 5972373

Table 4 - Summary of Resident Fish and Rainbows from Juvenile Coho Field Assessment Programs

Stream Name	Watershed Code	Number of Resident Fish	Rainbow Present	CT	DV	Sculpin	Stickleback
Kiskosh	91-9451	5	1	1	1	1	1
McNeil	40-0095	5	1	1	1	1	1
Antigonish	400-032400-	5	1	1	1	1	1
Marigonish	400-032600-	5	1	1	1	1	1
Salt Lagoon	915-765500-21900-	5	1	1	1	1	1
Pa-aat	97-8200-060	5	1	1	1	1	1
Denise	96-0300	5	1	1	1	1	1
Lost	Unknown	4	1	1	1		1
Moore Cove	91-9895	4	1	1	1		1
Spiller River	97-9300-080	4	1	1	1	1	
Prudhomme	96-0250-020	4	1	1	1		1
Moresby	950-852200-	4	1	1	1	1	
McNichol	96-0500	4	1	1	1	1	
Aberdeen	400-025100-	4	1	1	1	1	
Diana	96-0250-010	4	1	1	1	1	
Kloiya	96-0250	4	1	1	1	1	
Oona River	97-9300-130	4	1	1	1	1	
Stumaun	96-1000	4	1	1	1	1	
Porcher	97-9300-480	4	1	1	1	1	
Shawatlan	Unknown	4	1	1	1		1
Wolf	97-9300-360	4	1	1	1	1	
Airport	Unknown	4	0	1	1	1	1
Malsey	Unknown	4	0	1	1	1	1
Chambers	70-0200	3	1	1		1	
Valley	40-0200	3	1		1	1	
Hunt's Creek	Unknown	3	1		1	1	
Kubas	Unknown	3	1	1	1		
Dogfish Bay	910-971500-	3	1		1	1	
Kwinitsa	40-0330	3	1	1		1	
Chismore	97-9300-060	3	1	1	1		
Head	97-9300-371	3	1	1	1		
Wolf(Port Ed)	97-9300-360	3	1	1	1		
Humpback	97-9300-020	3	1		1	1	
Salt Lake	Unknown	3	1	1		1	
Silver	96-0400	3	1		1	1	
Shaw	97-8700-230	3	1	1		1	
Kitsault	96-2100	3	0		1	1	1
Skene Cove	Unknown	3	0	1	1	1	
Tea Bay	Unknown	3	0	1	1	1	

Table 4 contd

Stream Name	Watershed Code	Number of Resident Fish	Rainbow Present	CT	DV	Sculpin	Stickleback
Phoenix	97-9300-535	3	0	1	1	1	
LaHou	96-0850	3	0	1	1	1	
Swamp Island	Unknown	3	0	1	1	1	
Table Bay	915-742200-30500-	3	0	1	1	1	
Riordan	97-6950-180	2	1	1			
Cabin	Unknown	2	1			1	
Big Bay	910-503100-	2	1		1		
Quaal	91-9400	2	1	1			
Keesil	91-9495	2	1			1	
Inver	400-031400-	2	0		1		1
Hays	96-0200-060	2	0	1	1		
Welda	70-0400	2	0		1	1	
Haida Bay	Unknown	2	0		1	1	
Wilauks	96-2097	2	0		1	1	
Snass	97-9300-560	2	0	1	1		
Bremner	340-047200-917-342-443	2	0		1		1
Stagoo	96-1900	2	0		1		1
Scott Inlet	Unknown	2	0	1	1		
Illiance	96-2095	2	0		1		1
BillyBay	915-765500-06000-	2	0		1	1	
Slippery Rock	Unknown	2	0	1		1	
Uriah	Unknown	2	0		1	1	
Kitkiata	91-9390	2	0	1	1		
Basalt	Unknown	0	0				
Stapledon	Unknown	0	0				

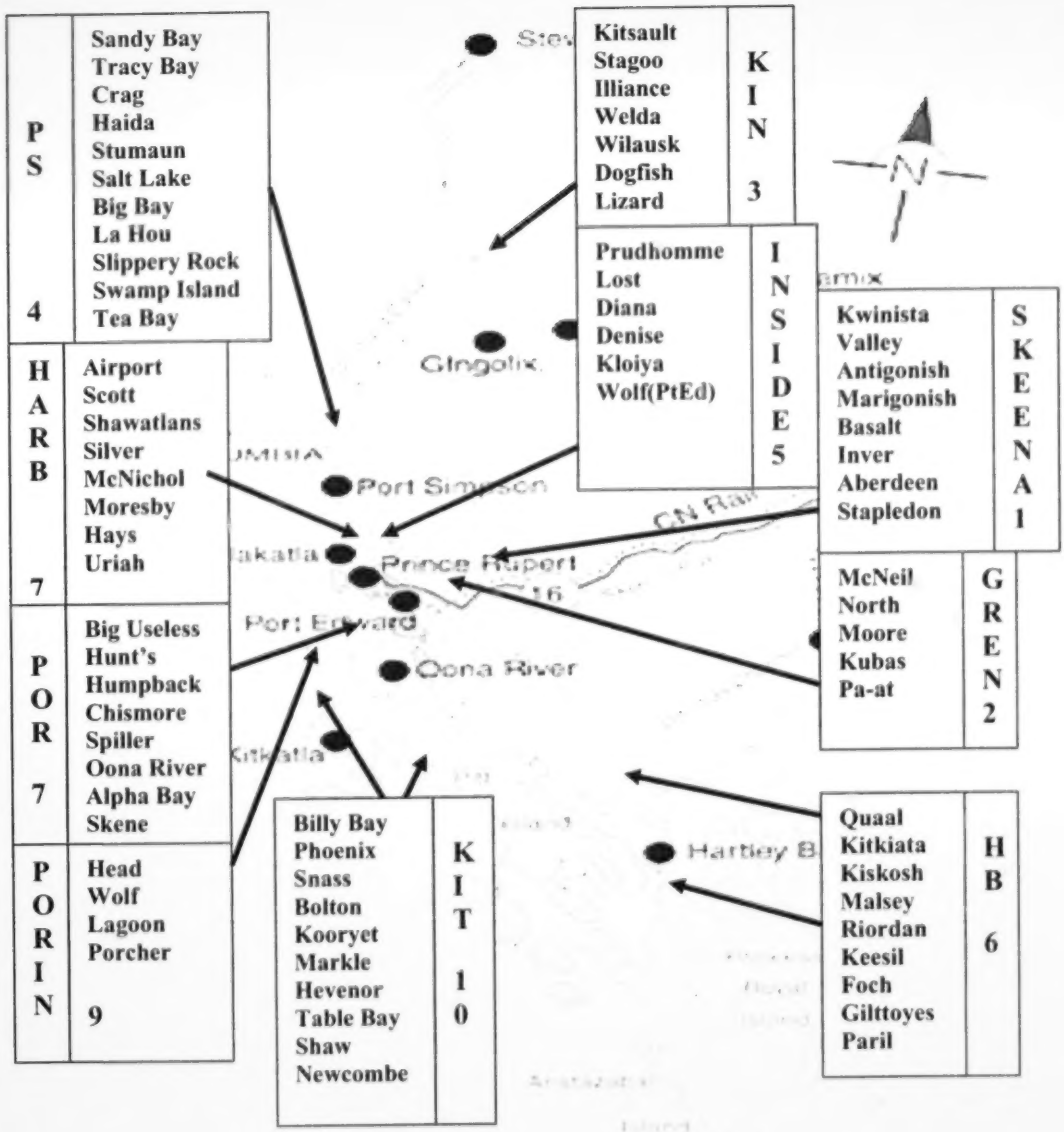

Figure 2 – Overview of Regions within North Coast LRMP